

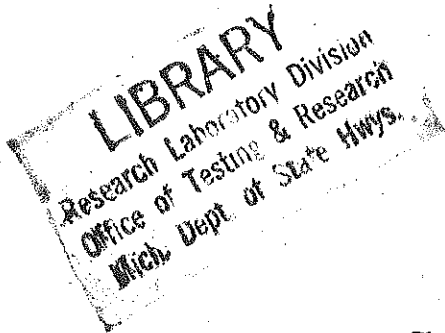
MICHIGAN DEPARTMENT OF STATE HIGHWAYS

INTERCHANGE RAMP COLOR DELINEATION AND MARKING STUDY

Continuous Route Application

INTERIM REPORT

ERRATIC MOVEMENT SURVEY REPORT



by

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Erratic Movement Survey

I. Introduction:

This report will describe a part of a 1965 survey designed to evaluate the use of color coding to guide traffic along a continuous section of freeway. Erratic movements were observed at 14 exit areas during July, August and September of that year. This data is the basis of this report.

System details and background information on this concept can be found in the reports "Interchange Ramp Color Delineation and Marking Study (Pilot Project)", Michigan Department of State Highways June 1965 and "The Effect of Color in Guidance of Traffic at Interchanges", Minnesota Highway Department 1963, respectively.

II. Study Site:

The site selected for this study was a 30-mile section of US-23 running north from Territorial Road north of Ann Arbor to Hill Road near Flint. (See Figure 1.)

The exit-ramps include 15 diamonds and 4 loops, with 1 left-hand exit connector ramp.

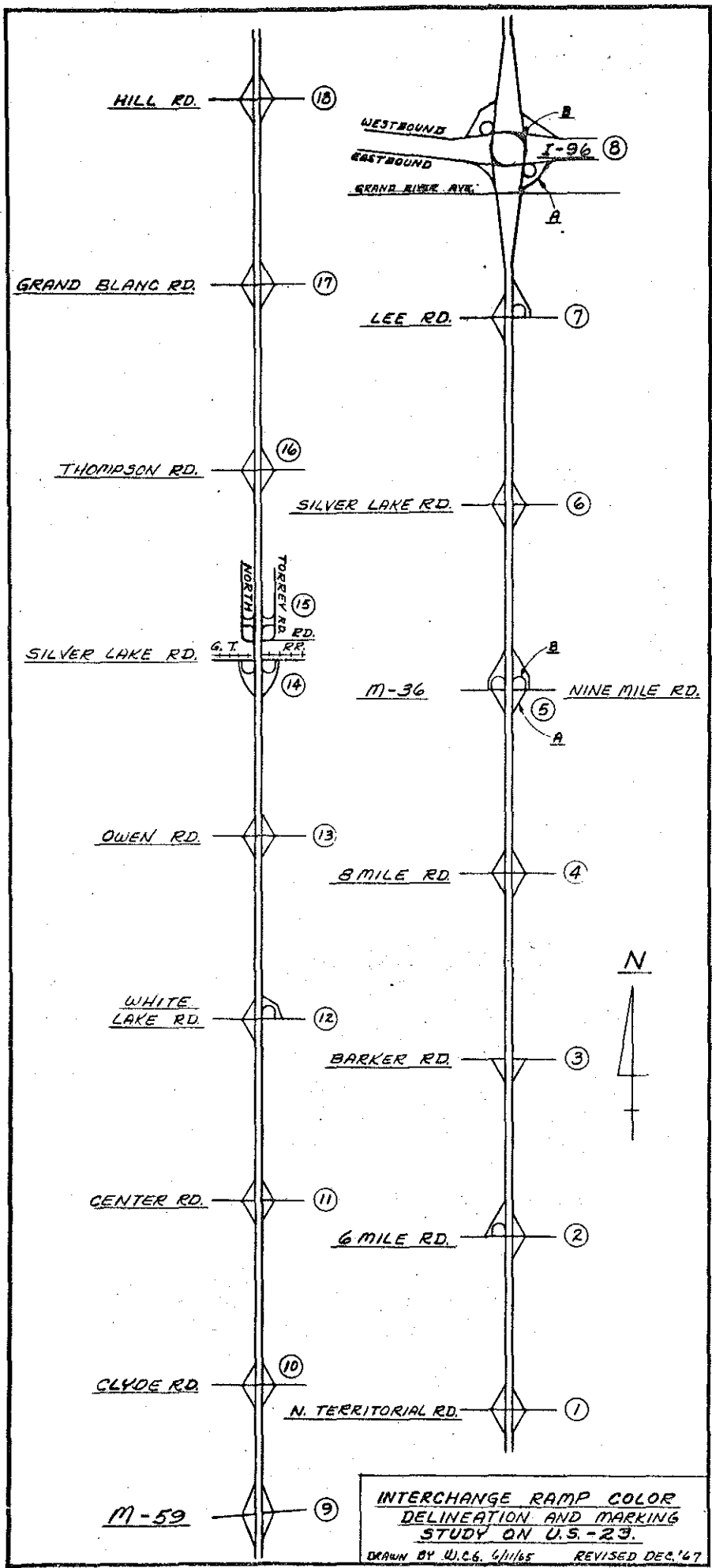


FIGURE 1

III. Description of Color Coding:

The physical study design remained essentially the same as the pilot study conducted in 1963 and published June 1965. Blue edgemarkings in 8" width were utilized at all exit ramps along with blue delineators. Through the interchange area along the "thru" roadway, white 4" edgemarkings with clear delineators were placed. The exit gore sign and the destination ramp signs were blue background with white legend. In contrast, the entrances were demarcated with yellow edgelines and delineators.

IV. Procedure:

Observation of driver's exit performance was made before and after the application of the color code. Sixteen hours were observed at each of 14 locations. The before study was conducted July 6 through July 20. The after study was conducted August 23 through September 3. Hereafter, in this report, these observations will be referred to as "before" and "after" respectively.

Erratic movements were classified according to the following descriptions:

1. Delayed Exit - This is a vehicle that delays its exit long enough to drive across the painted gore or dirt.
2. False Exit - This is a vehicle that begins its exit but returns to the through lanes.

3. Backing at Gore - This is a vehicle which stops beyond the gore and then backs up to go in a different direction. It was noted if vehicle backed up on ramp, or on the through roadway.
4. Rapid Deceleration or Swerve on Correct Path - This is a vehicle which drives the ramp on the path but has to take an abrupt action to do so.
5. Stopped or Slowed - This is a vehicle which comes to a complete stop to decide which way to go or is definitely confused on its direction and slows down to decide.

V. Conclusions:

The survey showed erratic movements were significantly reduced following the application of the color scheme. (Tables I & II).

The reduction in erratic movements "Delayed Exits" and "Rapid Deceleration" was greatest at exit ramps which were not diamonds. (Tables III & IV.) It would seem that additional guidance at hidden ramps is provided by the color scheme.

The reduction in "False Exit" and "Stopped or Slowed" erratic movements was the same at diamond and other ramps. (Tables V & VI.)

The reductions in erratic movements were proportionately the same for day and night. This would indicate that the color scheme aids the motorist in daytime as much as at nighttime. (Table VII).

The erratics seem most notably reduced following Exit Location 4. Whether or not this can be attributed to a beneficial effect of prior exposure to the color scheme will require further investigation.

VI. Data and Analysis:

Traffic volumes were only slightly higher in the after period so volumes were not considered in the analysis.

Table I presents a summary of erratic movements.

Table I
Erratic Movements

	<u>Before</u>	<u>After</u>
Delayed Exits	229	63
Stopped or Slowed	126	48
Rapid Deceleration or Swerve	149	105
False Exit	64	37
Backing at Gore	6	7
Totals	<u>574</u>	<u>260</u>

The term "Location type" as used in Table II refers to each location studied (12), and each type of erratic movement used in the analysis (4). Thus, for example, the entries "before" (11) and "after" (5) under Delayed Exit at Location 2 is a location-type.

Table II

Record of Observations

12 Locations	Period	Delayed Exit	False Exit	Rapid Dec. or Swerve	Stopped or Slowed	*Backing at Gore	
						Ramp	Thruway
2	Before	11	0	7	9	1	0
	After	5	1	21	5	0	0
4	Before	16	9	13	16	0	0
	After	16	6	17	4	0	0
5A	Before	1	9	12	7	0	0
	After	0	4	14	3	0	1
5B	Before	11	3	7	10	0	0
	After	5	2	9	5	1	0
7	Before	22	6	15	12	1	0
	After	1	6	1	5	1	0
8A	Before	1	3	34	9	0	1
	After	3	3	8	4	0	1
8B	Before	70	0	25	12	2	0
	After	13	2	6	6	0	1
9	Before	33	4	19	11	0	0
	After	10	5	4	10	1	0
13	Before	8	3	3	12	1	0
	After	2	0	2	0	0	0
14	Before	5	0	6	8	0	0
	After	4	1	16	6	0	1
15	Before	6	21	4	10	0	0
	After	0	6	5	0	0	0
18	Before	45	6	4	10	0	0
	After	4	1	2	0	0	0

48 Location-types analyzed.

34 Location-types indicated an improvement.

3 Location-types remained unchanged.

11 Location-types indicated a worsening.

The probability of 34 of 48 indicating an improvement when conditions remained unchanged is less than .002. Therefore, the improvement is significant.

*Backing at Gore excluded from analysis for this Table.

For Tables II through V, exits numbered 2, 4, 5A, 9, 13, 14 and 18 were grouped in Tables II, III, IV and V since they presented the driver with a Diamond Exit Ramp. Exits 5B, 7, 8A, 8B and 15 are grouped under "Other Ramps".

Table III

Delayed Exit Movements

	<u>Before</u>	<u>After</u>	<u>Totals</u>
Diamond Exit Ramps	119	41	160
Other Ramps	110	22	132
Totals	229	63	

Hypothesis tested: Diamond ramps and Other Ramps shared equally in the improvement.

$$\chi^2 = 3.4304 \quad .05 < P(\chi^2 > 3.43) < .1$$

The apparent greater improvement in Other Ramps as compared to Diamond Ramps might be attributed to chance.

Table IV

Rapid Deceleration or Swerve Movements

	<u>Before</u>	<u>After</u>	<u>Totals</u>
Diamond Ramps	64	76	140
Other Ramps	85	29	114
Totals	149	105	

Hypothesis tested: as above

$$\chi^2 = 21.5 \quad P(\chi^2 > 21.5) < .001$$

The improvement in the Other Ramps does not appear to be accounted for by chance; i.e., Other Ramps were aided more by the color scheme than Diamond Ramps.

Table V

False Exit Movements

	<u>Before</u>	<u>After</u>	<u>Totals</u>
Diamond Ramps	31	18	49
Other Ramps	33	19	52
	—	—	
Totals	67	37	

Hypothesis tested: Diamond Ramps and Other Ramps shared equally in the improvement.

$$\chi^2 = .0004 \quad P(\chi^2 \geq .0004) > .98$$

The hypothesis is accepted, i.e., Diamond and Other Ramps were aided equally in this movement.

Table VI

Stopped or Slowed Movements

	<u>Before</u>	<u>After</u>	<u>Totals</u>
Diamond Ramps	73	28	101
Other Ramps	53	20	73
	—	—	—
Totals	126	48	

Hypothesis tested: as above

$$\chi^2 = .0022 \quad P(\chi^2 > .0022) > .95$$

The hypothesis is accepted, i.e., Diamond and Other Ramps were equally improved for this movement.

Table VII

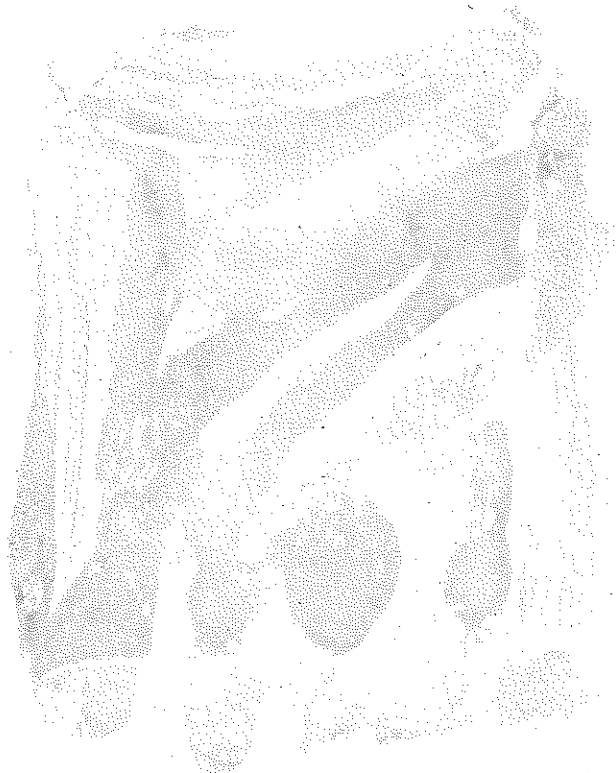
Day and Night Movements

	<u>*Day</u>	<u>Night</u>	<u>Totals</u>
Before	478	96	574
After	218	42	260

Hypothesis tested: Improvement in the day was proportional to the improvement noted at night.

$$\chi^2 = .042 \qquad P(\chi^2 \geq .042) > .8$$

The hypothesis is accepted, i.e., Day and night showed equal reductions in erratic movements.



*The night observations were of 4 hour duration and daytime was 12 hours.